Losses of bioactive polyacetylenes during minimal processing of carrots

Influence of minimal processing on levels of bioactive polyacetylenes of the falcarinol type in carrots

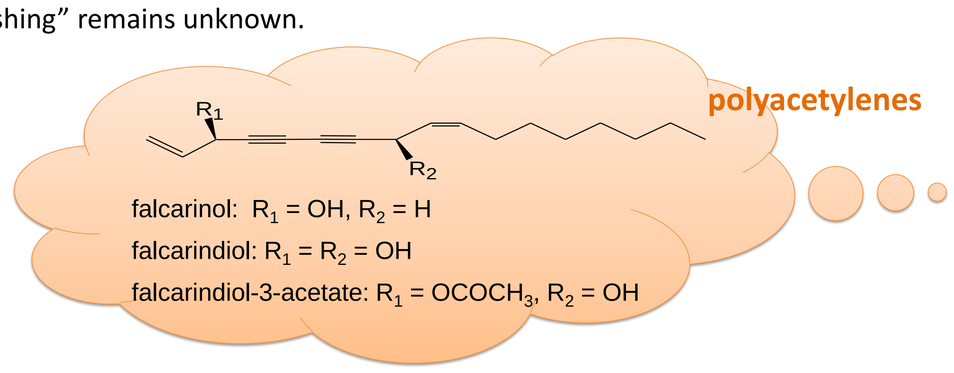
Tassos Koidis[1,2], Ashish Rawson[1,3], Teresa Osorio[4] and Nigel Brunton[1]

[1] Teagasc Food Research Centre, Ashtown, Dublin, Ireland
[2] Institute of Agri-Food and Land Use, School of Biological Sciences, Queen's University of Belfast, UK
[3] Department of Biochemistry, National University of Ireland Galway, Galway, Ireland
[4] School of Agriculture, Food Science and Veterinary Medicine, University College Dublin, Belfield, Dublin, Ireland

INTRODUCTION

Vegetables of the Apiaceae plant family such as carrots, parsnip, celery and parsley, contain in minor quantities, a group of bioactive aliphatic C17-polyacetylenes (falcarinol, falcarindiol, falcarindiol-3- acetate). Recent studies have highlighted important biological functions *in vitro* and *in vivo* (animal studies) although the beneficial effect in human nutrition attributable to an increased in polyacetylenes diet are yet to be confirmed (Lund, 1990).

Carrots not only contain relatively high polyacetylene content but also form a significant part of many countries dietary habits. Carrots are also present in some ready-to-eat foods such as chilled freshly prepared salads, as part of the increasingly popular minimally processed foods. Whereas the effect of conventional processing (boiling, vacuum processing) on the levels of polyacetylenes has been relatively well studied, the effect of minimal mechanical operations such as "peeling", "mechanical cutting" and "chlorine washing" remains unknown.

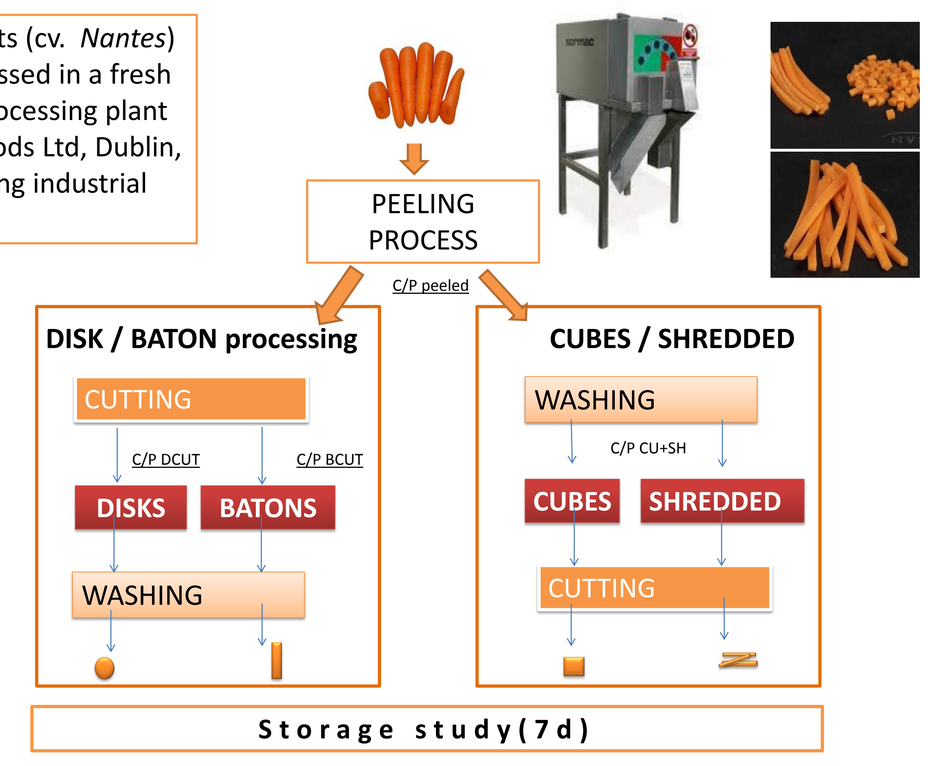


AIM OF THE STUDY:

To investigate a) the effect of standard minimal processing procedures in the retention of polyacetylenes in carrots and b) their changes after subsequent chill storage.

EXPERIMENTAL AND METHODOLOGY

Fresh carrots (cv. *Nantes*) were processed in a fresh produce processing plant (Wonderfoods Ltd, Dublin, Ireland) using industrial equipment



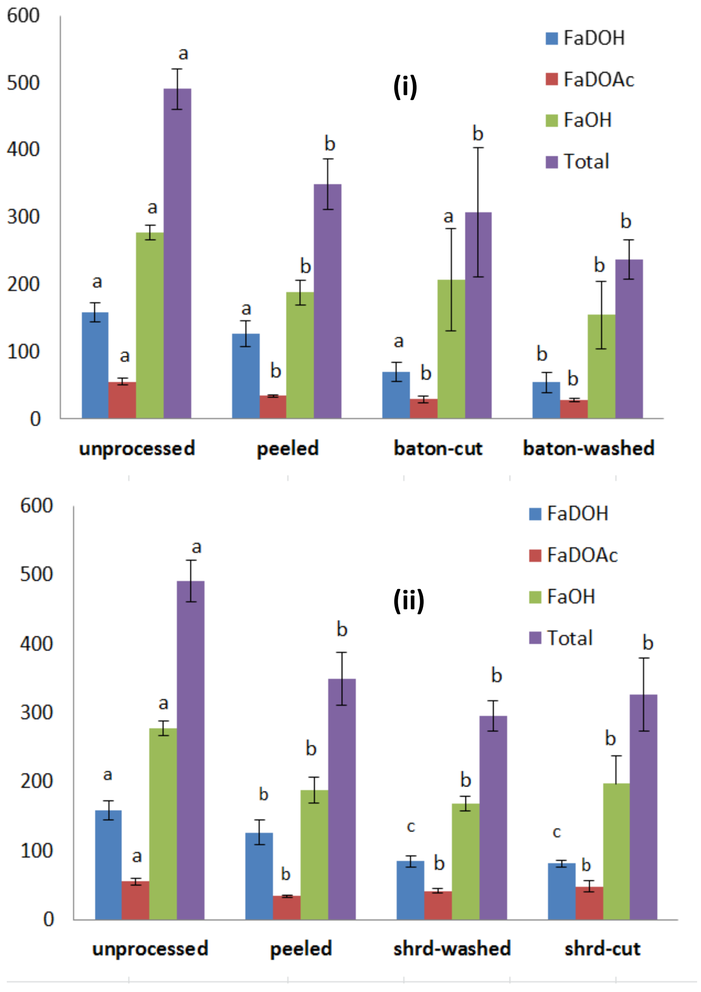
EXTRACTION & HPLC ANALYSIS:

Freeze dried carrots were extracted using Accelerated Solvent Extraction (ASE) using Dionex ASE 350 equipment. Chromatographic separation of polyacetylene extracts was achieved on an Agilent HPLC with UV 208 nm detector using a gradient system of water and acetonitrile.

RESULTS AND DISCUSSION

EFFECT OF MIMINAL PROCESSING ON THE LEVELS OF POLYACETYLENES

The results showed that the initial total polyacetylene levels of unprocessed carrots (~500 mg/kg dry carrot) were significantly decreased ($p<0.05$) following peeling and remained lower at the end of the minimal processing (Figure 1). This decrease was more evident when carrots were cut in disks (5mm thickness), cubes (0.5x0.5x0.5cm) on batons (4x0.5x0.5cm) and less when shredded. In terms of individual polyacetylenes, the same trend was observed (Fig. 1- results for "disks" and "cubes" are not shown).



After the stage of peeling where significant decreased where found, there was no significant difference in losses for all three polyaceytelenes during cutting and chlorine washing. In can be noted that falcarinol, the most bioactive of the polyacetylene family, was retained better than the rest during minimal processing although there was some variation in the HPLC measurements.

Figure 1. Levels of poly-acetylenes (FaDOH: falcarin diol, FaDOAc : falcarindiol-3-acetate and FaOH: falcarinol) following different stages of industrial carrot minimal processing **(values in mg PA/g dry carrot weight)**

i. When carrot are cut in batons
ii. In shredded carrots

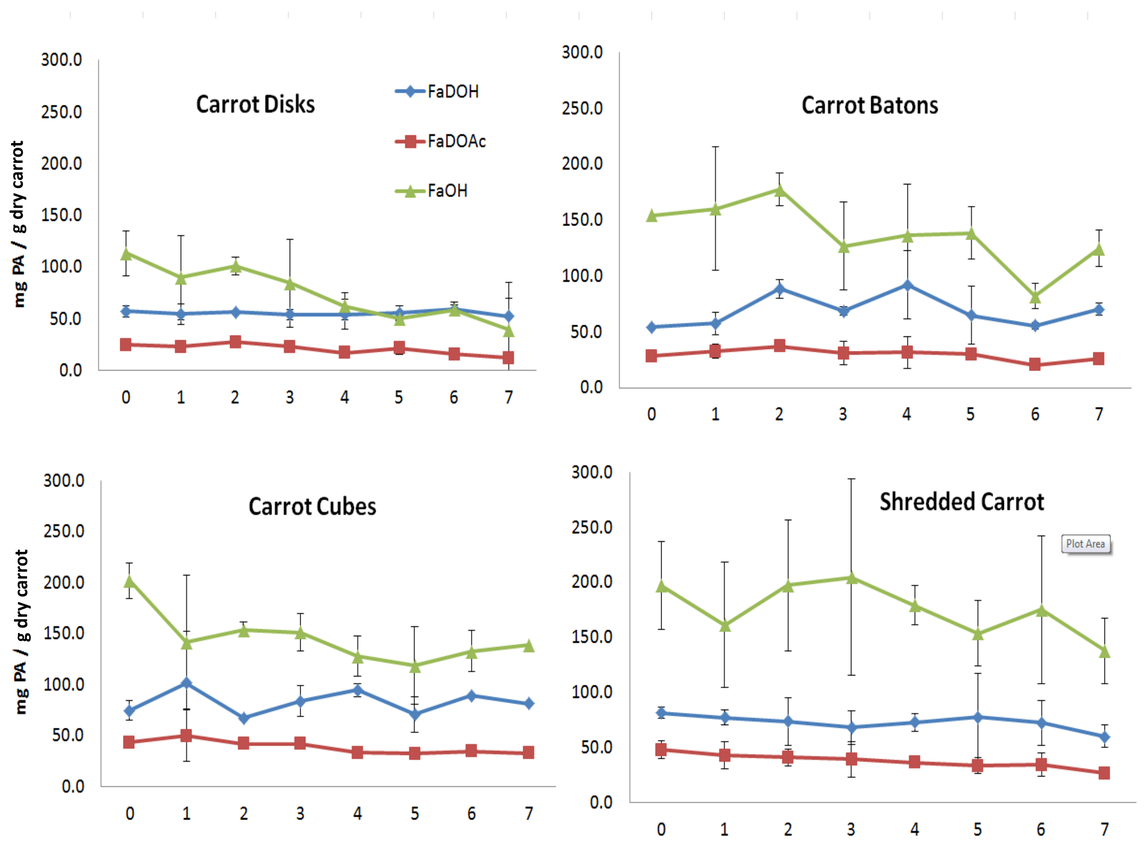


Figure 2. Levels of three polyacetylenes, falcarinol (FAOH), falcarindiol (FaDOH) and falcarindiol-3-acetate (FaDOAc) during chill storage (4°C ± 0.1) in a display unit. Carrots were prepared in disks, baton, cubes or shreds and stored (150g) in 20x20cm PP bags

LOSSES OF POLYACETYLENES DURING CHILL STORAGE

Storage studies on the fate of polyacetylenes were limited to 7d which is a maximum expected shelf life on a minimally processed product (Fig. 2). During this period there was a slight decrease in falcarinol content especially in carrots cut in disks, cubes and batons. However this trend was not significant. For the other two polyacetylenes, results showed little differences between day 1 and day 7. Overall, the levels of polyacetylenes are fairly stable during chill storage.

DISCUSION & CONCLUSION

This work showed that the levels of polyacetylenes in minimally processed carrots are affected particularly during the initial mechanical operations (mainly during peeling as carrot skin is rich in polyacetylenes) and remain rather stable during short term chill storage. As polyacetylenes are potential health promoting compounds, their retention could be considered.

Even if these mechanical operations are essential, there is scope for optimisation of conditions during peeling (the depth of peeling, the time in contact with chlorinated water during washing or size of carrot cut) to minimise the losses of polyacetylenes. These optimisations - that could come in the form of recommendations for processors - should however take into account the microbiological safety, the organoleptic quality as well as the equal retention of other bioactives present in carrots such as vitamins and minerals.

REFERENCES:

1) Lund ED, White JM. Polyacetylenes in normal and waterstressed lsquo Orlando Goldrsquo carrots (*Daucus carota*). *Journal of the Science of Food and Agriculture* 1990; **51**: 507-16.

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